Managing the Diabetic Patient: A Closer Look

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Once an individual is diagnosed to have diabetes a number of events usually follow and the patient usually finds himself referred to the Diabetic clinic at the Diabetic outpatients department at St Luke's Hospital. This setting has been developed over the years and it is aimed to offer specialised management to diabetic patients by diabetologists.

Many diabetic patients are also cared for, by their own Family doctor in the private setting. Whoever the care giver is, the most important factor is that continuity of care and patient support are ensured. This can be a problem without a patient registration system, where the patient-doctor relationship is lacking. Patient education and support for self management is of paramount importance in complex chronic diseases such as diabetes. There needs to be good liaison between the various health care specialists when dealing with diabetic complications, such as the ophthalmologist, vascular surgeon, dietician and podologist.

Assessment of newly diagnosed patient

History

1. Duration of symptoms e.g. thirst, polyuria, weight loss
2. Possible secondary causes of diabetes e.g. acromegaly
3. Family history
4. Concurrent complications of diabetes
5. Presence of risk factors e.g. smoking, hyperlipidaemia, hypertension.

Examination

1. Body mass index (BMI)
2. Cardiovascular system (BP and peripheral pulses)
3. Signs of peripheral and autonomic neuropathy
4. Eyes to exclude retinopathy

Investigations

The relevance and type of investigations carried out will depend on the outcome of history and examination but should include the following:

1. Blood tests for creatinine, urea and electrolytes, a full lipid profile and thyroid and liver function tests
2. Urine tests for ketones and albuminuria(macro and micro)
3. An ECG

Current recommendations for glycaemic control

The American Diabetes Association currently recommends an HbA1c level of less than 7 percent for all diabetic patients to decrease the risk of long term microvascular complications[1]. Levels stipulated by the International Diabetes Federation are similar though somewhat more stringent as can be seen from Table 1 (on the right).

These recommendations were adopted from the research protocols of landmark studies[2]. Both bodies acknowledge that blood glucose level targets should be individually determined and based on the individual patient's characteristics, including the patient's risk of hypoglycaemia, ability to sense hypoglycaemic symptoms, as well as the concurrent co-morbidities such as cardiovascular disease and seizure problems.

The A1c reflects glycaemic control in the previous 90 days, but is more weighted by the most recent values. The glycaemia control within the last 30 days contributes about 50% of the A1c value, while 90 to 120 days before the test contribute 10% to the final value of the A1c.[4]

Preparation for A1c Testing Self-monitoring of blood glucose (SMBG) done several times a day for one to two weeks before an A1c test greatly improves the effectiveness of a periodic consultation.

What is significant change, in a patient's blood glucose parameters?

If a patient's register entry for HA1c reads 6.7% and 7.5% six months apart, does it mean there has been significant deterioration? The answer to this

Table 1. Recommendations for glycaemic control

	HbA1c	*Preprandial BG*	*Post Prandial BG*
ADA	<7.0%	<5.0-7.2mmol/1	<10.0mmol/1
IDF	<6.5%	<6.0mmol/1	<8.0mmol/1

Table 2. Correlation between A1c Level and Mean Plasma Glucose Levels[3]

A1c	*Mean Plasma Glucose*
6	7.5mmol/1
7	9.5mmol/1
8	11.5mmol/1
9	13.5mmol/1
10	15.5mmol/1
11	17.5mmol/1
12	19.5mmol/1

question will have meaning in any auditing exercise about the outcome of any intervention, be it dietary or exercise modification advice or treatment regimens. The question above really has two questions:

1. Is change **statistically** significant or is it an error due to intra patient variability with laboratory results?
2. Is the change **clinically** significant? i.e. does it translate into a change in patient clinical outcomes?

To answer the first question one has to determine the overall variability of HbA1c estimation method and biological variability. For A1c estimations the coefficient of variation CV_T is about 6%. The formula to estimate the least significant change (LSC) in a set confidence interval $_Z$(CI) is: $LSC = {}_Z\sqrt{2}xCV_T$.

One thus has to set a confidence level at which one is to decide that any change is real and not just "noise". Thus to be 80% confident (z=1.28) that change between two readings is real, the LSC = 1.28x 1.414 x 6 =10.9%. Now change in this scenario is [7.5/6.7-1]x100%=11.94% which is greater than the LSC calculated above. Thus the change in HbA1c can be considered significant with 80% confidence (hence 20% false alarm possibility).

Having determined that the change in A1c is statistically significant, we can now attempt to answer the second question, whether the change has clinical sequelae. The DCCT[1] and UKPDS[2] studies provide us with data relating change in A1c with clinical outcomes. In a patient with type2 diabetes a *1% deterioration in A1c* is expected to *reflect a 30% adverse microvascular risk increase*. Thus risk of retinopathy (a complication from microvascular disease) is increased by 24% if HbA1c deteriorates by an absolute increase of 0.8% (i.e. 6.7% to 7.5%).

This knowledge will make the patient and his caring team focus more on the need to achieve an HbA1c less than 6.5% once more to minimise the dreaded long term complications.

Self-monitoring of blood glucose

Recommendations for the use of self monitoring of blood glucose (SMBG) in type 1 diabetes are explicit while in the case of type 2 are less so, particularly because it was thought that type 2 patients were less likely to suffer from life threatening hypos and hyperglycaemias. However SMBG is a tool that can help type 2 diabetic patients understand and gain control of their disease and more patients should be encouraged to use this tool in clinical practice.

Evidence based recommendations of SMBG

The recommendation of SMBG for patients who have type 1 diabetes are based on the results obtained from the DCCT (Diabetes Control and Complications Trial) [2] which evaluated the relationship between A1c levels and rates of complications. The test times (fasting, preprandial and night-time) were chosen to minimise the risk of hypoglycaemia and a two-hour post prandial test was chosen if the patient did not achieve the pre-set HbA1c target. To date literature review did not encounter any RCT comparing the outcomes of different testing regimens.

In the case of type 2 diabetics, the optimum frequency for SMBG is simply "not known"[5]. Recent reviews of RCTs on the evidence of SMBG in type 2 diabetes found a few trials which had inconsistent results.[6]

Interpretation of blood glucose values

It is evident that the blood glucose levels taken at any point in time, contribute to the overall glycaemic control, however for practical reasons it is important to standardise times at which blood glucose readings are more useful. It comes with no surprise the fact that if preprandial glucose is high post prandial levels will definitely be higher. Post prandial testing has the important limitation of intrapersonal variability associated with the type of food ingested. The glycaemic index (GI) of different foods reflects the differing carbohydrate composition of foods which will give different blood glucose levels due to their rate of digestion and absorption. The GI is calculated by comparing the particular food with a standard food (white bread which is given a value 100). The GI principle relies a lot on scientific precision which is not realistic. A better working modification is the glyacemic load (GL) which is calculated as: {GI x carbohydrate (g)}/100. Thus whereas a food may have a high GI, if one eats very little of it, the GL will be small. A proposed method for achieving BG control is to:

1. Get the fasting BG on target
2. Get the BG before evening meal on target
3. Check HbA1c. If not on target check for periods of high blood glucose during the rest of the day or even at night.

Thus the three most relevant BG readings should be:

1. Fasting, 2. before lunch, 3. before dinner (and if uncontrolled 2 hours after dinner)

References

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